Amendments to the Specification

Please amend the paragraph starting at page 1, line 19 and ending at line 24 as follows.

It is noted that this invention is applicable to all apparatus that use print media such as paper, cloth, leather, nonwoven cloth, OHP sheets and even metal sheets. Examples of applicable ~~device~~ devices include office equipment, such as printers, copying machines and facsimiles, and industrial manufacturing devices.

Please amend the paragraph starting at page 4, line 25 and ending at page 5, line 6 as follows.

A technique using a so-called head shading to prevent [[a]] density variations of a printed image and thereby improve a printed image quality has also been developed. A commonly ~~know~~ known head shading technique involves printing a test pattern of a uniform grayscale value on a print medium, optically detecting density variations, and performing corrections, such as addition or subtraction, on the grayscale values of an output image as it is printed.

Please amend the paragraph starting at page 5, line 20 and ending at page 6, line 11 as follows.

Such a technique to correct a density variation of a printed image is disclosed, for example, in Japanese Patent Application Publication No. 3-33508(1991), and Japanese Patent Application Laid-open Nos. 61-283273(1986), 3-166959(1991), and

7-242004(1995). The above image quality improvement effort using the head shading, however, is basically intended to correct variations in volume of ink ~~droplet~~ droplets ejected from each nozzle. For example, the head shading is not intended to improve the image quality to an optimum level when an ink droplet ejected from a faulty nozzle landed on a position significantly far from an ideal position, i.e., failed to land on an ideal position. Particularly in a full-multiple type ink jet printing apparatus using full-line heads of a so-called full-line printing system, which completes an image associated with a particular print head by performing only one scan of the print head relative to a print medium, there is a call for further image quality improvements.

Please amend the paragraph starting at page 7, line 17 and ending at line 24 as follows.

Further, if some trouble occurs with a part of the nozzle column, conventionally, due to the presence of such defective nozzle, the print head is obliged to be treated as a low quality print head, which may ~~resulting~~ result in a disposal of the print head. In the case of elongate print heads, this practice wastes a large number of normally functioning nozzles, posing a serious problem in terms of cost and ecology.

Please amend the paragraph starting at page 7, line 25 and ending at page 8, line 11 as follows.

Furthermore, such elongate nozzles as described above have a greater chance of experiencing nozzle ejection characteristic variations. For example, nozzles with

ink ejection volume variations or those with landing position deviations may concentrate in ~~a part~~ some of the ~~whole~~ nozzles. In ~~the~~ conventional practice, print heads with ~~some trouble~~ any defects are all disposed of as faulty products. However, among the print heads treated as faulty products, there are ~~not a few~~ some products whose ejection volume variations and landing position deviations are small and which have only a few faulty nozzles. Making use of these discarded products will reduce a manufacturing cost of the apparatus and its realization is being called for.

Please amend the paragraph starting at page 13, line 21 and ending at page 14, line 15 as follows.

With the invention having the above-described construction, since the dot deviation correction is performed based on the deviation data representing an amount of deviation, or a difference, between an actual landing position of an ink dot formed on the print medium by an ink droplet ejected from each nozzle of the print head and an ideal landing position of the ink dot and since the deviation correction means is made to selectively execute the dot deviation correction according to the amount of deviation, even if the print head has a faulty nozzle whose dot landing position greatly deviates from an intended position, it is possible to produce a high-quality image with no visible bands or stripes. Therefore, print heads with such faulty nozzles do not have to be replaced and can be used for a long period of time. Not only does this ~~reduces~~ reduce the running cost of the apparatus significantly but it is also desirable from an ecological point of view. This

invention therefore can practically improve a yield of print heads in a production line and reduce a production cost of the print heads.

Please delete the paragraph starting at page 15, line 11 and ending at line 15.

Please amend the paragraph starting at page 15, line 22 and ending at line 23 as follows.

Fig. 2 is an enlarged schematic view showing a construction of an ink jet print head [[A]] <u>21</u> of Fig. 1;

Please amend the paragraph starting at page 16, line 3 and ending at line 5 as follows.

Fig. 4B is an example step chart for identifying faulty nozzles in a print head, formed by a print head having faulty nozzles at 18th, 28th and 30th ~~position~~ <u>positions;</u>

Please amend the paragraph starting at page 16, line 9 and ending at line 11 as follows.

Fig. 5B is an example dot chart for identifying faulty nozzles in a print head, formed by a print head having faulty nozzles at 18th, 28th and 30th ~~position~~ <u>positions;</u>

Please amend the paragraph starting at page 17, line 5 and ending at line 10 as follows.

Fig. 9B is an explanatory diagram showing how a plurality of ink dots formed by ink droplets ejected from nozzles ~~affect~~ affects one of ideal matrix lines in the first embodiment, and also illustrating in a magnified state three rows of dots d(—1), d(m), d(m+1) at a center of the dot group of Fig. 9A;

Please amend the paragraph starting at page 17, line 21 and ending at line 23 as follows.

Fig. 11B is an explanatory diagram showing a method of calculating a degree to which a plurality of ink dots ~~affect~~ affects one of ideal matrix lines;

Please amend the paragraph starting at page 18, line 6 and ending at line 9 as follows.

Fig. 15B is an example step chart for identifying faulty nozzles in a print head, formed by a print head having faulty nozzles at 18th, 28th and 30th ~~position~~ positions; and

Please amend the paragraph starting at page 30, line 14 and ending at line 26 as follows.

To describe in more detail, in a process ranging from an ink ejection from print head nozzles to a dot landing on a print medium, ink droplets landing ~~position~~ positions sometimes deviate from ~~an~~ ideal landing ~~position~~ positions. The ejected ink

droplets may not fly in an intended direction or ~~receive resistances~~ may encounter resistance as they fly. Even after landing on a print medium, ink droplets are affected by an uneven surface of the print medium and their abilities to soak and fix in the print medium. Because of these uncontrollable factors, forming dots of a perfectly uniform shape at appropriate positions is difficult to achieve. That is, it is extremely difficult to form ideal dots such as shown in Fig. 7A.

Please amend the paragraph starting at page 31, line 20 and ending at page 32, line 10 as follows.

With this head shading correction, however, there are cases where ~~correction~~ corrections cannot be made and desired ~~effect~~ effects are not obtained. For example, when ink droplets ejected from the third nozzle and the ink droplets ejected from the fourth nozzle cross each other and land as shown in Fig. 7B, a desired effect from the correction may not be produced. That is, when the density of the third unit matrices is high, this problem is traced to an improper ejection volume of the fourth nozzle. In this case, if the head shading processing is performed by matching read image densities against nozzle positions and reducing the ejection volume of the third nozzle, as described above, it is understood that the correction of the ejection volume does not work well for the correction of image density variations because the ink dots d3 ejected from the third nozzle land on fourth unit matrices.

Please amend the paragraph starting at page 36, line 6 and ending at line 18 as follows.

Returning to Fig. 8, the operation that follows step S2 will be explained. As described above, the Y deviation ~~value~~ values of faulty nozzles are measured at step [[3]] S3 and, based on the measured values, nozzle profile information is generated (step S3). Next, by referring to the nozzle profile information, HS data is generated (step S4). Based on the HS data, HC data (Head Correction Table) that corresponds to the size of input image print data is generated (step S5). Then, using the generated HC data, the print data of an input image is transformed and a printing operation is executed according to the transformed print data (step S6).

Please amend the paragraph starting at page 36, line 22 and ending at page 37, line 3 as follows.

Fig. 9A schematically illustrates, from [[let]] left to right, a print head 21, an ideal print matrix MT, a state of ink dots that landed ideally on the ideal print matrix MT, and a state of ink dots that failed to land ideally on the ideal print matrix MT. For simplicity of explanation, the print head 21 is shown to have only five nozzles. Fig. 9B is an enlarged view showing details of ~~central~~ three ink dot rows in the center of the dot group of Fig. 9A.

Please amend the paragraph starting at page 47, line 16 and ending at page 48, line 10 as follows.

To obtain the nozzle information, a first step to be taken is to print a step pattern PT1, such as shown in Fig. [[4]] 15A, by using a printing apparatus of Fig. 1. The step pattern PT1 consists of short printed line segments, eight segments from eight nozzles in each row, formed by causing each nozzle to eject color dots continuously or non-continuously over a short distance. This pattern printing is performed for a required number of nozzles. This step pattern PT1 indicates by how much distance the ink dots formed deviate in a vertical direction in the figure from the ideal print matrix MT. More specifically, the printed step pattern (or step chart) PT1 is scanned by a sensor (not shown) to measure by how many micrometers the line segments deviate from their ideal landing positions. The measured deviations are used as nozzle profile information. Rather than using the sensor, it is also possible to visually determine deviated positions and amounts of deviation to generate nozzle profile information and input this information into the printing apparatus. This nozzle information is prepared for each print head.

Please amend the paragraph starting at page 51, line 1 and ending at line 8 as follows.

First, at step [[S1]] S41, a step chart of a step pattern PT1 and a solid chart of a solid pattern PT2 are printed, as shown in Fig. 15. Next, a printed density of the solid chart is measured by an optical sensor (not shown) and, based on measured density

variations in the solid chart PT2, variations in ink ejection volume among nozzles are determined and stored as head shading data ([[HC]] HS data) (step [[S2]] S42).

Please amend the paragraph starting at page 51, line 9 and ending at line 17 as follows.

At step [[S2]] S42, the printed step chart is read by an optical sensor (not shown) and, based on the data thus read, deviations between dot landing positions and an ideal print matrix are measured. This measurement may be done visually. Further, the volumes of ink droplets ejected are measured by printing a dot chart of Fig. 5 and measuring the sizes and shapes of dots that have landed on a print medium with an optical sensor (not shown).

Please amend the paragraph starting at page 52, line 10 and ending at line 13 as follows.

At step [[S3]] S43, as in the preceding embodiments, a measurement is made of a Y deviation value, which constitutes an important parameter in generating the nozzle profile information.

Please amend the paragraph starting at page 52, line 14 and ending at line 18 as follows.

Following the generation of the nozzle profile information through the measurement of the Y deviation values of the faulty nozzles, step [[S4]] S44 checks the HS data and the nozzle profile data (NP data) for faulty nozzles.

Please amend the paragraph starting at page 53, line 23 and ending at page 54, line 6 as follows.

When a large-deviation failed nozzle should occur, HC data (head correction table data) is generated for those nozzles in the vicinity of that failed nozzle by a deviation correction control method described below (step [[S5]] S45). The HC data is integrated with the HS data to generate HS data for the entire print head. Using the generated HS data, a grayscale correction is performed on an output image signal to generate corrected print data (step [[S6]] S46). A printing operation is now executed according to the corrected print data (step [[S7]] S47).

Please amend the paragraph starting at page 54, line 7 and ending at line 12 as follows.

At step [[S4]] S44 above, if no large-deviation failed nozzle is found, the HC data generation at step [[S5]] S45 is omitted and a grayscale correction is performed on image print data by using the HS data which was determined at step [[S2]] S42, i.e., the original HS data not considering the HC data.

Please amend the paragraph starting at page 55, line 1 and ending at line 17 as follows.

While the present invention is particularly effective in a 1-pass printing system, it is also effectively applicable to a so-called multipass printing system in which one and the same print area is scanned multiple times by different groups of print head nozzles to complete an image on that area. In general multipass printing ~~system~~ systems, after a faulty nozzle is detected, the area printed by that faulty nozzle is printed by other nozzle groups during different scans to alleviate an image quality degradation caused by the faulty nozzle. With this invention, however, the image quality degradation by a faulty nozzle can be prevented by a simple processing method in virtually the same scan. Combined with the advantage of the multipass printing system, the present invention therefore can form images of even higher quality.

Please amend the paragraph starting at page 55, line 18 and ending at page 56, line 8 as follows.

Further, this invention is particularly effective in an ink jet printing apparatus in which a plurality of nozzles are arrayed in a direction almost perpendicular to the printing scan direction in such a way that an interval between adjoining nozzles that can print simultaneously in the same scan is set almost equal to an interval of pixels of an image to be printed, as shown in Fig. 2, i.e., in a full-line type ink jet printing apparatus that completes an image printing in a single scan. The full-line type ink jet printing apparatus basically has advantages over the multipass printing system in that it has a

simpler construction and that it has a much faster printing speed. Applying the present invention to the full-line type system can improve an image quality and thus realizes an ink jet printing apparatus with excellent ~~performances~~ performance in terms of cost, printing speed and image quality.